

Ecosystem Investigation

Ecosystem/Biodiversity of Life

Concepts

An ecosystem is a group of interacting organisms and nonliving factors in a specific area. All ecosystems have similar characteristics (Trophic levels: consumers, producers, decomposers). Native species arrived in Hawaii by wind, wing, or wave. Alien or introduced species are accidentally or intentionally brought by human activities. Endemic species are only found in a given area.

Overview

In this lesson, students will explore an ecosystem of Hawaii with a focus on “Biodiversity”. Teachers may choose their own ecosystem, but this exercise will use the ecosystems found in Hawaii Volcanoes National Park. “Biodiversity” will be introduced to the students and they will begin to discuss why biodiversity is important. Biodiversity is the variability among living organisms on the earth, including the variability within and between species and within and between ecosystems. Students will be exposed to photographs of study areas and the ecosystems within them. Then they will be broken up into small groups to further explore organisms of assigned ecosystem. The goal of this exercise is to learn about flora and fauna in their own “backyard” while identifying potential threats to the ecosystems and their “biodiversity”. They will have to identify at least 2 native and or endemic species and two introduced or invasive species. Students will research these species and be tasked to understand their importance to the ecosystem, and identify the threats each faces. In conclusion, the class will share their findings with each other and then be prompted to compare and contrast these areas.

Purpose

Students will be able to define ecosystem and biodiversity and understand the importance of biodiversity to an ecosystem. They will also identify the abiotic and biotic factors that make up an ecosystem and understand that human and natural actions has a affect on their surroundings. Students will identify environmental conditions that are associated with certain ecosystems.

Materials

- Classroom computers with Internet access
- PowerPoint: Images of your area of investigation (Hawaiian Rain forest, montane forest, Dry forest, lowland dry desert, intertidal zone, sandy shore, and Coral Reef).
- Map of Area (Hawaii, poster size, Map of Hawaii Volcanoes National Park, poster size).
- Books, magazines, video, websites or any other literature relevant to your ecosystem.
- Worksheets to help student gather information for presentation.

Background Information/Preparation

Gather photographs and information on the area or ecosystem you are going to investigate. For example, photos of Hawaiian rain forests and its habitats like the Hawaiian Honeycreeper, Coral reefs and the reef fish and invertebrates. Gather literature materials for student research. Review abiotic and biotic factors, native, endemic, and introduced species. Review organism interactions and the different trophic levels: consumers, producers, and decomposers. Place the maps in your classroom.

Motivation

The students in your classroom should be aware of the natural world around them, especially here in Hawaii, where over 90% of its native terrestrial flora and fauna are endemic. Many of these species are threatened and the student will help educate each other about what organisms are present and identify potential threats to the ecosystem. Explain to the students that every action taken has a reaction. Human activity along with environmental conditions can dramatically impact organisms and the habitat they live in. Review native and endemic species and suggest what kinds of impacts introduced alien species can have on them.

Safety

This is a no stress activity and worrying is not allowed.

Activity

Day 1 (total time 3-4 hrs)

1. First, identify how native and endemic species arrived in Hawaii. Introduce the three "W's" which are wind, waves, and wing. Students can be challenged to identify ways native species arrived. For example, how do you think the Hawaiian Hawk arrived? How about native grasses? The Hawaiian Picture Winged Flies? Then have students brainstorm about how introduced species arrived. Create a list on the board.
2. Explain to students that in this lesson, they will be answering the following questions: What is biodiversity? Why is biodiversity important? What kind of effect can alien introduced species have on an ecosystem and its biodiversity?
Note: Students may not be aware of organisms present in the ecosystem. It might be necessary to introduce images of identified organisms (both introduced and native or endemic) found there.
3. Introduce the maps, in this lesson, it will be a map of Hawaii and the area of Hawaii Volcanoes National Park (HVNP). Provide some background information to the students and identify the ecosystem(s). In this particular lesson, Hawaii Volcanoes National Park boundaries include several ecosystems or ecological life zones: Coastal (sandy shore, coral reef, intertidal), lowlands, rain forest, mid-elevation forest, upland forest, sub-alpine and alpine. HVNP is one of a few natural areas in the State of Hawaii protecting habitat from sea level to the summit.
4. Introduce images of the ecosystems and organisms. This will peak their interests and also help give them some idea of what they are researching. (PowerPoint).
5. Assign your classroom into small research groups of 3-4, and have them randomly draw out an ecosystem to investigate. For homework, task them to begin the research of their ecosystems.

Note: Assign groups that allow at least one student with internet access to gather research materials for the group.

Day 2+ (Researching information using computers with internet access or the library)

6. Students will brainstorm abiotic and biotic factors found in their ecosystem and verify their list when they conduct their research. They will also create a list of the organisms found in their ecosystem. This list will help determine what species they chose to investigate.

Note: Identifying species will likely be guided by the teacher. The students may also need to be pointed in the right direction to find actual species in their ecosystem.

7. Students will be tasked to identify the characteristics of the ecosystem (elevation, temperature, rainfall, etc.) and plot the area on the classroom map. They will also investigate at least 2 native and or endemic species, and at least 1 introduced or invasive species. They will present to the class the importance of their ecosystem or one of the species they researched. They will also discuss the challenges facing the ecosystem or species, and whether or not they are human-induced.
8. Computers with internet access should be made available for this portion as well as a trip to the library to gather materials.

Presentation Day

9. Finally, each group will share their research to each other. Once all groups are done, students will compare and contrast ecosystems. They will discuss environmental factors common to all and some that are unique to a specific ecosystem. Organisms may also be categorized this way also. Students should discuss why biodiversity is important and why preserving biodiversity enhances the life of everyone. Have them discuss habitat and species loss around the world.

Concept Discovery

Students will understand that organisms are critical to the survival of their ecosystem and the stability of the ecosystem is crucial to species survival. Environmental factors help define the limits of an ecosystem and the inhabitants of it. Human activity can help preserve or threaten ecosystems stability. Conservation and awareness of our natural environment is everyone's responsibility.

Going Further/Extension

Have students research like conservation areas in other states or countries and compare them to the one they researched focusing on the similarities in environmental factors, threats, and the variety of species found in each. Have students develop management plans for the problems they researched.

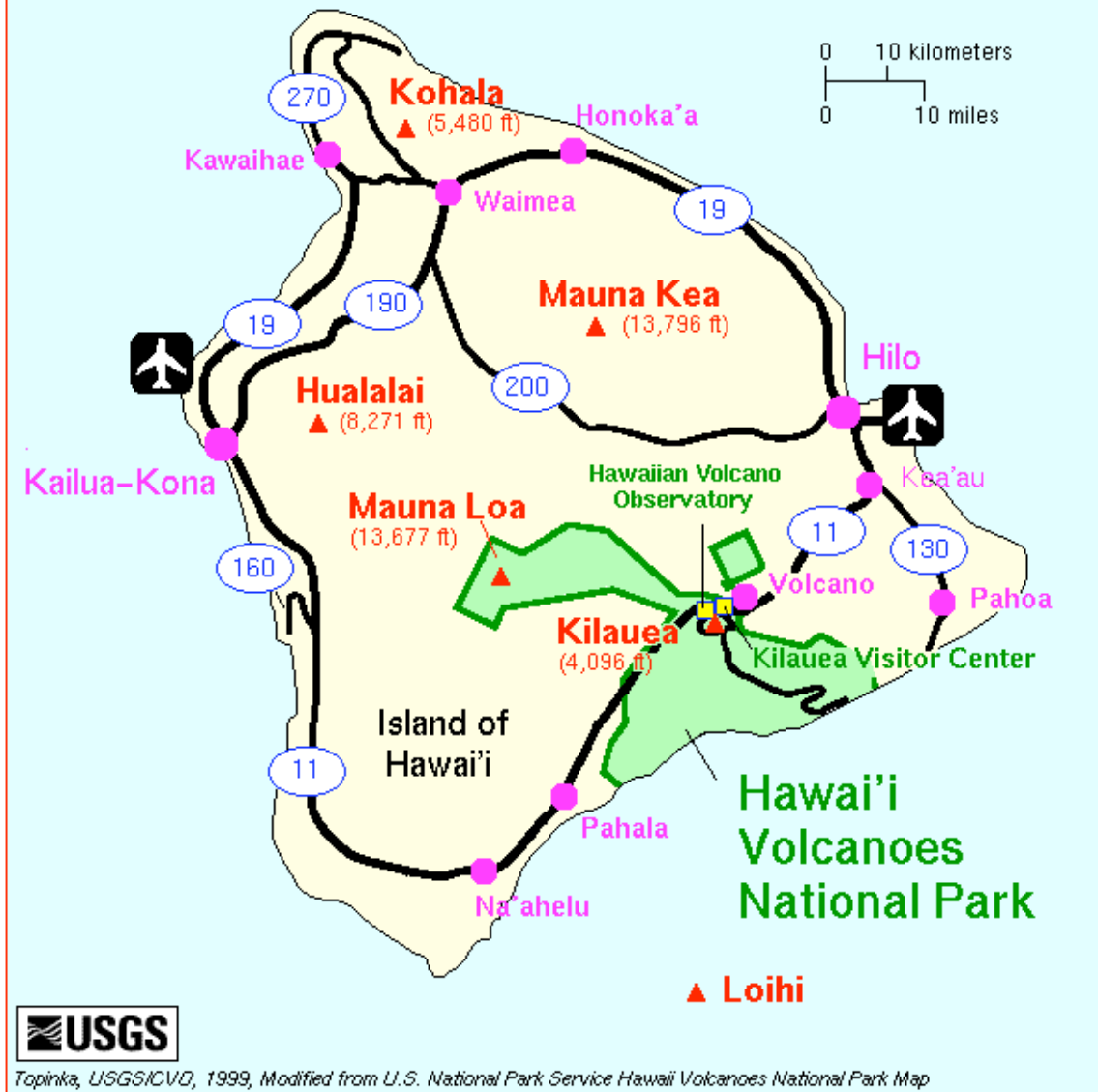
Assessment

Students will present as a group the ecosystem characteristics and organisms researched. Alternately, students will write an essays that provide information about the ecosystem and organisms they researched, detailing the challenges they may face.



<http://walrus.wr.usgs.gov/coralreefs/images/hawaii.jpg>

Volcanoes of the Island of Hawai'i



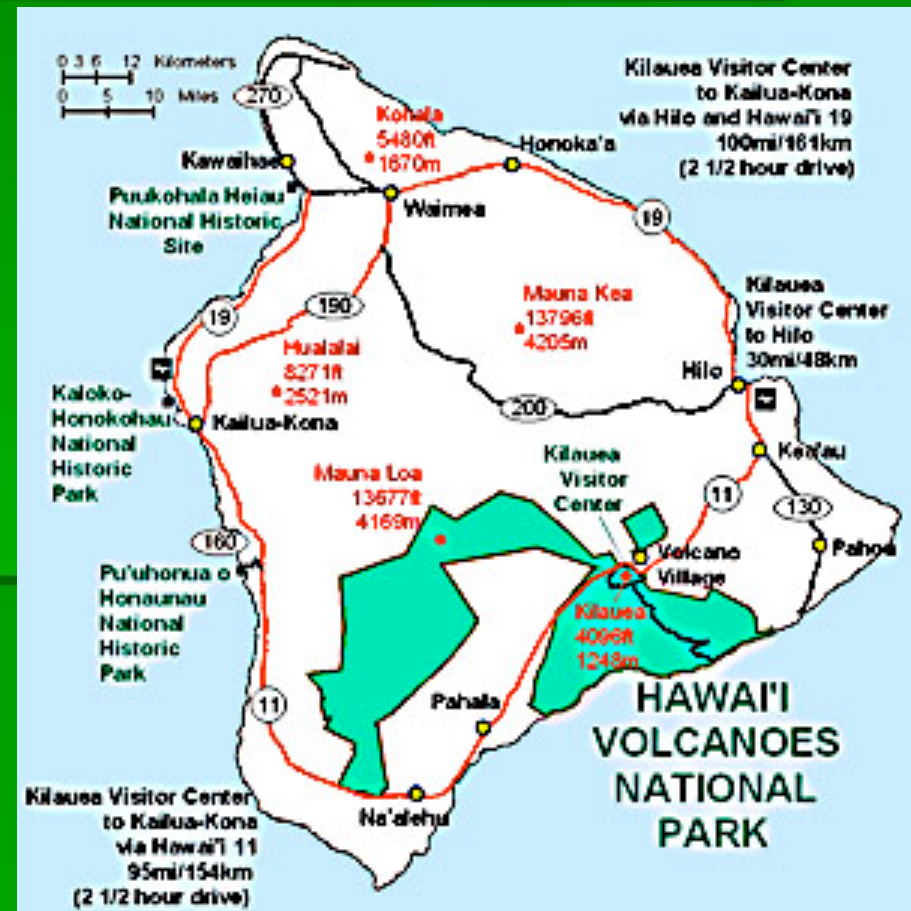
http://vulcan.wr.usgs.gov/Imgs/Gif/Hawaii/Maps/map_big_island.gif

Ecosystems: A look at Hawaii Volcanoes National Park

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HVNP

- The Park is located on the Southeastern side of the Big Island
- It encompasses 330,000 Acres
- Ranges from sea level to 13,677 feet.
- Established in 1916
- Average annual rainfall 110 inches
- Average high temperature 63.5° F
- Average low temperature 52.5° F



Rain Forest



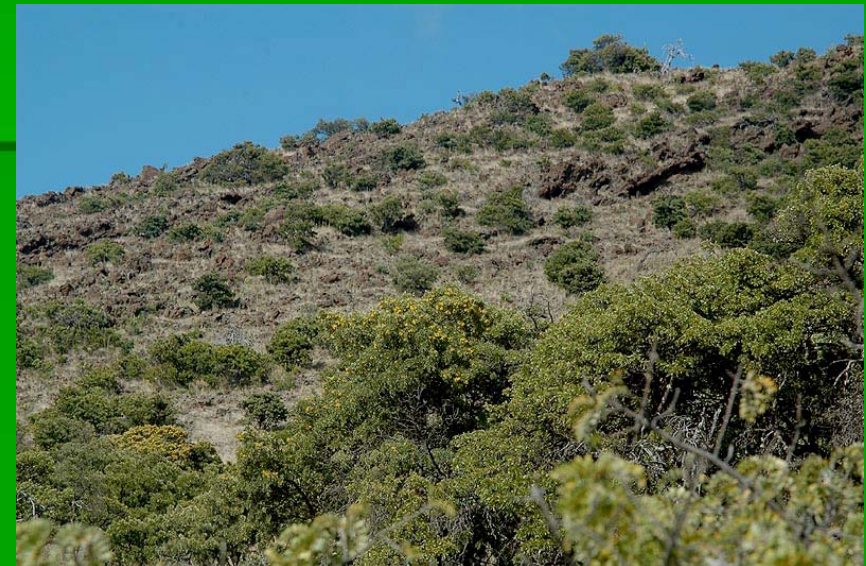
Hawaii Volcanoes National Park
Feral Pig
liwi
Happy Faced Spider
Hapuu



Sub-Alpine/Alpine



- Mauna Loa
- Palila
- Silversword
- Mamane forest
- Wekiu Bug



Mid-elevation Forest



- Koa and Ohia Forest
- Pueo
- Picture Winged Flies



Coastal



- Halape



Desert



- Kau Desert
- Pukiawe
- Nene
- Mongoose
- Aalii



Ecosystem_____

Student Names_____

Hawaii Volcanoes National Park (75 pts total, 100 with extra credit)

Instructions: This portion will be information on the Park itself. Read the entire worksheet before visiting the websites listed at the bottom of the page. This will make it easier for you to answer the questions. Do not forget to include the measurement type of each answer (Feet, Celsius, Acres, etc.). Answering “of your ecosystem” is optional; you will get extra credit (5 pts each) if you can **find** your specific ecosystems environmental characteristics on your own. This will require some research.

When was the Park Established? (Date)_____

What is the elevation range of the Park? _____of your ecosystem_____

What is the annual rainfall in the Park? _____of your ecosystem_____

What is the average high and low temperature in the Park? _____

of your ecosystem_____

What is the area of the Park?_____

Name 5 of the ecological-zones found in the Park (there are 7 of them)?

Name 5 organisms found in the park (extra credit 5 pts: if you can name one bird, one insect, one mammal, one non-insect, and one reptile).

(BONUS Questions)

(2pts) What is the average annual visitor rate? _____

(3pts) Name 3 volcanic features in the Park._____

The following websites can help you with the questions above.

<http://www.nps.gov/archive/havo/manage/2004facts.pdf>

<http://www.nps.gov/archive/havo/visitor/climate.htm>

Give each team about 20 index cards. As they research the above points, teams should use index cards to describe the oceanographic, meteorological, and physical features of the sanctuary. They should also create a card for each species found in the sanctuary, writing its name on the front and any other pertinent information about it (is it endangered? what threats does it face? is it unique to this area? what is its food source?) on the back. (These cards will be used later in a whole class activity.) Give groups about 45 minutes to an hour to complete their research. When teams have completed their research, bring the class back together and show the [video interviews](#) with sanctuary managers. Then invite teams to share their information. Have teams present their findings first for one sanctuary then the other. Instruct the students to take notes on the findings of each team.

After each team has presented their findings, draw a large Venn diagram on the board. Using one circle to represent Cordell Bank National Marine Sanctuary and one to represent the Hawaiian Islands Humpback Whale National Marine Sanctuary, have the students place their cards on the diagram using magnets or tape. When all the cards have been placed, lead a class discussion about the results. Ask students:

Which aspects of the physical environment are the same in both sanctuaries? Which are different?

How many species are found in both sanctuaries?

Are there more species that are unique to one or the other sanctuary, or can many be found in both? Why do you think this is?

Which species can be found in both sanctuaries? Do they use the sanctuaries for different purposes (breeding, feeding, etc.)? What does this imply about the importance of the sanctuaries?

Direct students to go back to their teams and return their species cards to them. Tell them they will now be investigating food webs. (A review of food webs can be found [here](#).)

Using their species cards, each team should create a basic food web for their sanctuary. Have each team use half of the board to arrange their cards and use arrows to show which animals eat and are eaten by others. When the food webs are complete, have students return to their seats. Ask students to consider the effects of changes to the environment or one or more species in each food web. For example, ask "What would happen if there were a sudden dying of phytoplankton in the Cordell Bank sanctuary?" Students should note that as primary producers, phytoplankton support the entire food web and the effects would be felt throughout. Help guide students in reflecting on the effects on the various levels of the food web of different changes.